



298168

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 ecology and environment, inc.

111 WEST JACKSON BLVD., CHICAGO, ILLINOIS 60604, TEL. 312-663-9415

International Specialists in the Environment

Date Received for Review: 5/14 Date Review Completed: 5/14

TO: Tim Boos / Phil Smith

FROM: Zena Gold-Kaufman *ZGK*SUBJECT: ChemetCo
FIL 0523Sample Description: Case # 28825
X Dioxin samplesProject Data Status: complete

FIT Date Review Findings:

NO hits for 2,3,7,8 TCDD
Several hits in other isomers.

Additional Comments:

NoneBook No. 6Page No. 70

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: 5/12/87

ECT. Review of Region V CLP Data
Received for Review on 5/11/87

FROM: Curtis Ross, Director (SSCRL) Patrick J. Chumilla
Central Regional Laboratory

TO: Data Users: ECT

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We have reviewed the data for the following case(s).

SITE NAME: Chemtrec SMO Case No. SAS 2782E
EPA Data Set No. SF 3916 No. of Samples: 5 D.U./Activity Numbers 4051 072100

SMO Case No. 87FB05505 - 87FB05505

SMO Traffic No. E01 - E05

CLP Laboratory: Triangle Hrs. Required for Review: 7

Following are our findings.

1. CALIBRATION: ION RATIOS AND RESPONSE FACTORS ARE OK
2. COLUMN SEPARATION IS ACCEPTABLE
3. SURROGATE RECOVERY IS OK
4. MATRIX SPIKE AND DUPLICATE ARE IN AGREEMENT
5. THE BLANK WAS CLEAN. DETECTION LIMITS ARE OK.
6. SAMPLES ARE REPORTED ON A DRY WEIGHT BASIS. SPOT CHECK ON CALCULATIONS WAS OK.

Patrick J. Chumilla
5-12-87

- { } Data are acceptable for use.
{ } Data are acceptable for use with qualifications noted above.
{ } Data are preliminary - pending verification by Contractor Laboratory.
{ } Data are unacceptable.

cc: Dr. Alfred Haebeler/Joan Fisk/Gary Ward, EPA Support Services
Ross K. Robeson, EMSL-Las Vegas
Don Trees, CLP/Sample Management Office

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

ESD/Central Regional Laboratory
DATA TRACKING FORM FOR CONTRACT SAMPLES

CRL Data Set No. 5F3916 CERCLIS No. _____

SNO Case No. 5152882E Site Name and Location: Chem-Tec

Name of Contractor or EPA Laboratory: Triangle Data User: Bit

No. of Samples: 5 Date Samples or Data Received: 5/1/87

1. Have chain-of-custody records been received? YES ☒ NO ☐
2. Have Traffic Reports or packing lists been received? YES ☒ NO ☐
3. If no, are Traffic Report or packing list numbers written on the chain-of-custody record? YES ☒ NO ☐
4. If no, which Traffic report or packing list numbers are missing?

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Are basic data forms in? YES ☒ NO ☐

Number of samples claimed: 5 Number of samples received: 5

Checked by: Midia Feliciano Date: 5/1/87

Received by Contract Project Management Section: P. Churilla Date: 5/4/87

Review Started: 5-11-87 Reviewer Signature: Patricia J. Churilla

Total time spent on review: 7 HRS Date review completed: 5-12-87

Copied (xeroxed) by: U. Jette Date: _____

Mailed to Data User by: Midia Feliciano Date: 5/13/87

DATA USERS:

Please fill in the blanks below and return this form to: Sylvia Griffin, Data Management Coordinator, Region V, 5SCRL

Data received by: _____ Date: _____

Q.A. review received by: _____ Date: _____

Inorganic Data Complete [], Suitable for Intended Purposes [] ☒ [] if acceptable.
Organic Data Complete [], Suitable for Intended Purposes [] List problems below.
Dioxin Data Complete [], Suitable for Intended Purposes []
SAS Data Complete [], Suitable for Intended Purposes []

See Attached "Missing Data Request Form" []

PROBLEMS: Please indicate reasons (if any) why data are not suitable for your uses.
Other problems.

Received by Data Management Coordinator, CRL for File: Date: _____

Signature: _____

TRIANGLE LABORATORIES, INC.
4915F PROSPECTUS DRIVE
RESEARCH TRIANGLE PARK, NC 27713
919 544-5729

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CASE NARRATIVE

MAY 1 1987

DATE : April 25, 1987

CLIENT NO.: SAS 2882E

TLI NO.: 8701364

OBJECTIVE: ANALYSIS OF SEDIMENT, SOIL AND SLAG SAMPLES FOR THE PRESENCE OF TETRA THROUGH OCTA CHLORO-DIBENZODIOXINS AND FURANS

The samples were extracted by the enclosed protocol. On the sample data sheets the concentration is given in parts per billion (ppb). "RT" is the retention time on the gas chromatographic column in minutes and seconds, "number" is the number of isomers in the totals reported for each group, and "ratio" is the ratio observed for the M to M+2 ions for the tetra through penta chlorinated compounds and M+2 to M+4 for the hexa through octa. "DL" is the detection limit in parts per billion. For quantitation, the sum of the areas for the two masses monitored is used. When no peak is detected an area of 2 counts for each ion (total 4 counts) is used to calculate the detection limit.

The samples were spiked with 10 ng of 13C-2378-TCDD, 37Cl-2378-TCDD, 13C-2378-TCDF, 13C-123478-HxCDF, 13C-12378-PCDD, 13C-123678-HxCDD, 13C-1234678-HpCDD, and 20 ng of 13C-OCDD prior to the extraction. For GC/MS analysis, the final extract was dissolved in 20 ul of toluene containing 13C-1234-TCDD and 13C-123789-HxCDD at a concentration of 500 pg/ul to measure the recovery of the 13C- labeled internal standards.

Samples were analyzed using a VG 7070H mass spectrometer and 11-250 data system, operated in the selected ion recording mode, at a resolution of 5000. A Varian 3700 GC was employed, with a DB-5 60m x 0.32mm id fused silica capillary column. One microliter of the 20 microliters final sample volume was injected, splitless, at a column temperature of 150 deg C, and heated ballistically to 190 deg C, then programmed at 3 deg/min to 300 deg C. A continuing calibration was demonstrated by injecting a solution of the analytes at a concentration of 100 pg/ul for the tetra isomers, 500 pg/ul for the penta through hepta and 1000 pg/ul for the octa, and a constant value of 100 pg/ul for 13C-2378-TCDD, 13C-2378-TCDF, 13C-123478-HxCDF, 37Cl-2378-TCDD, 13C-12378-PCDD, 13C-123678-HxCDD, 13C-1234678-HpCDD, and 200 pg/ul 13C-OCDD. Response factors (RF) were calculated for the analytes from this continuing calibration. For the totals in each group the response factor is taken as the average of the response factors for the individual isomers listed. Note that in some cases, when only one isomer is present, there may be a discrepancy between the amount given for the individual isomer and the total, since a different response factor may be used.

Delta RF on the data sheets for the continuing calibration is the difference between the daily response factor and the response factor in the initial calibration.

Positive identification criteria for chlorinated dibenzodioxins and furans are as follows:

1) Ratio of M+ to M+2 or M+2 to M+4 is within 20% of the theoretical value, except for the tetrachloro which are taken within 13%.

Acceptable ranges of the ratios for identification of chlorine containing compounds:

M/M+2

tetra 0.67-0.87

penta 0.49-0.73

M+2/M+4

hexa 0.98-1.48

hepta 0.82-1.24

octa 0.70-1.06

2) Retention time for analytes is within 3 seconds of the corresponding ¹³C internal standard or surrogate standard.

3) The identification of specific isomers that do not have corresponding ¹³C12-labeled standards is done by comparison of the retention time of the analyte to the nearest internal standard retention time with reference to the comparable retention times found in the continuing calibration.

4) If the retention time and the ratio are correct for identification of an isomer, the signal to noise ratio (S:N) must be greater than 2.5.

5) For confirmation of 2378-TCDD and 2378-TCDF, the samples are run on a second GC column. 2378-TCDF is not fully resolved from other TCDF isomers on a DB-5 column, so the concentration obtained from the full screen analysis is considered a maximum. The concentration of 2378-TCDF obtained on the second column is sometimes less than that indicated by the full screen analysis, because of the increased GC resolution.

6) For confirmation of 2378-TCDD and 2378-TCDF, the GC resolution from its nearest isomer must be >25% valley. The ions for masses corresponding to M-COCl are also monitored for confirmations. The column performance check solution contains the following isomers: 2347, 2348, 2378, 2367, 3467, and 1368-TCDF, and 1478, 2378, 1237, 1238, and 1234-TCDD.

Sample E05 was used for the matrix spike and matrix spike duplicate. The matrix spike was 5 ng per sample of 2378-TCDD and 2378-TCDF, 25 ng for the penta though hepta chlorinated compounds, and 50 ng for the octa. Calculations for the percent recovery and precision are enclosed.

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GC/MS Conditions
(FULL SCREEN ANALYSES)

Gas Chromatography:

Instrument: Varian 3700

Capillary Column: a. Manufacturer - J&W Scientific
b. Liquid phase - DE-5
c. Length - 60 m
d. I.D. - 0.25 mm
e. film thickness - 0.25 microns

Carrier gas : Helium

Head pressure : 28 psi

Flow thru column: 1 to 2 ml/min.

Injection type : Splitless for 30 sec.

Initial isothermal temperature : 150 deg C for 30 sec.

Initial temperature program rate: to 190 deg C ballistically

Final temperature program rate : to 300 deg C @ 3 deg/min

GC/MS Conditions
(2378-TCDD CONFIRMATION)

Gas Chromatography:

Instrument: Varian 3700

Column: a. Manufacturer - 1) Supelco, inc
2) J&W Scientific
b. Liquid phase - 1) SP-2331
2) DB-17
c. Length - 1) 30 m
2) 15 m
d. I.D. - 0.32 mm
e. film thickness - 0.25 microns

Carrier gas : Helium

Head pressure : 14 psi

Flow thru column: 1 to 2 ml/min.

Injection type : Splitless for 30 sec.

Initial isothermal temperature : 150 deg C for 30 sec.

Initial temperature program rate: to 170 deg C ballistically

Final temperature program rate : to 220 deg C @ 4 deg/min

Mass Spectrometry:

Instrument: VG Micromass 7070H

Ionization mode : EI, positive ion

Reactant gas : N/A

Resolution : 5000

Scan mode : selected ion recording

Switching mode : voltage

Reference standard: PFK

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EXTRACTION OF SOIL AND ASH SAMPLES

After addition of an equal amount of anhydrous sodium sulfate and internal standard and surrogate spike solution, the samples are extracted with toluene in a Soxhlet apparatus for 16 hours. The extract is chromatographed as described below.

PURIFICATION

Column A1: Silica gel with basic and acidic layers. From the bottom, these layers are: 1 g activated silica gel, 2 g silica gel with 1N sodium hydroxide (2:1), 1 g silica gel, 12 g silica gel with concentrated sulfuric acid (3:2), 2 g silica gel and 1 cm of sodium sulfate on the top.

Column A2: Directly under column 1, a 2nd column of 6 g A-948 activated alumina with 10% water. The sample is loaded onto column 1 and the column is rinsed with 90 ml hexane. Column 1 is removed and the sample is eluted from column 2 with 20 ml of 1% methylene chloride in hexane (which is set aside for PCE analysis or in case of breakthrough) and 20 ml of 20% methylene chloride in hexane (dioxin fraction).

Column B: Mixed 124 g 545 celite and 10.7 g AX-21 carbon. Freewash with : 2 ml 50% benzene/ethyl acetate, 1 ml 50% methylene chloride/cyclohexane, and 2 ml hexane. After adding 1 ml of hexane, the dioxin fraction is loaded on the column, which is then rinsed with 2 ml 50 % methylene chloride/hexane followed by 2 ml of 50% benzene/ethyl acetate. The column is inverted, and the sample is eluted with 4 ml of toluene.

The sample is evaporated to dryness with nitrogen and redissolved in 20 ul of toluene containing the recovery standards 13C12-1234-TCDD and 13C12-123789-HxCDD, for GC/MS analysis.

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EXAMPLE CALCULATIONS

SURROGATE, SAMPLE, OR INTERNAL STANDARD RESPONSE FACTORS:

$$\frac{(A_s)(I_{is})}{(A_{IS})(I_s)} = RF$$

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WHERE:

A_s = AREA OF SAMPLE <FROM RIC> 2378-TCDD 2297+2887 = 5184

A_{is} = AREA OF APPROPRIATE INTERNAL STANDARD 2281+2764 = 5045
13C12-2378-TCDD

I_{is} = CONCENTRATION OF INTERNAL STANDARD 100 pg/ml

I_s = CONCENTRATION OF ANALYTE 100 pg/ml

EXAMPLE: FROM FILE M870770

$$\frac{[5184][100]}{[5045][100]} = RF = 1.028$$

The areas of the 2 masses monitored for the analyte are added and compared to the sum of the areas for the 2 masses monitored for the internal standard, except for the surrogate 37Cl-TCDD where only one mass is monitored (328), which is compared to the 334 ion in the internal standard, 13C12-2378-TCDD.

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SURROGATE * RECOVERY:

1). Amount of surrogate found =
$$\frac{(A_s)(I_{is})}{(A_{is})(RF)}$$
 13C12-TCDF

WHERE:

A_s = AREA OF SAMPLE 4336 + 5387 = 9723

A_{is} = AREA OF INTERNAL STANDARD

3101 + 3866 = 6967

13C12-2378-TCDF

I_{is} = AMOUNT OF INTERNAL STANDARD IN TOTAL EXTRACT 10 ng

RF = RESPONSE FACTOR FOR SURROGATE

(from Continuing Calibration m870770) 1.337

EXAMPLE: 13C12-TCDF

FILE: m870771

$$\frac{(9723)(10 \text{ ng})}{(6967)(1.337)} = 10.44 \text{ ng}$$

2). % Recovery =
$$\frac{[\text{Found}]}{[\text{Spiked}]} \times 100$$

% Recovery (for above sample) =
$$\frac{[10.44]}{[10]} \times 100 = 104 \text{ \% Recovery}$$

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CALCULATIONS OF INTERNAL STANDARD RECOVERY:

1).
$$\frac{(A_{IS})(I_{RS})}{(A_{RS})(RF_{IS})} = \text{Amount of Internal Standard Found}$$

WHERE:

A_{IS} = AREA FOUND FOR INTERNAL STANDARD 13C12-2378-TCDD 3101 + 3866 = 6967

A_{RS} = AREA FOUND FOR RECOVERY STANDARD 2512 + 3208 = 5720
(13C-1234-TCDD)

I_{RS} = AMOUNT OF RECOVERY STANDARD IN EXTRACT 500 pg/ μ l

RF_{IS} = RESPONSE FACTOR FOR INTERNAL STANDARD 1.356
(from Continuing Calibration m 70770)

13C12 2378-TCDD

FILE: m 70771

$$\frac{(6967)(500 \text{ pg}/\mu\text{l})}{(5720)(1.356)} = 449.1 \text{ pg}/\mu\text{l}$$

2). % Recovery =
$$\frac{(\text{Amount of Int. Std. Found})}{(\text{Amount of Int. Std. Added})} \times 100$$

$$\frac{(449)}{(500)} \times 100 = 89.8 \% \text{ Recovery}$$

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CALCULATIONS OF DETECTION LIMITS:

$$DL = \frac{(A_S)(I_{IS}) \times 2.5}{(A_{IS})(WT.)(RF)}$$

WHERE:

A_S = Area of sample channel integrated through the center of noise across a region corresponding to the baseline peak width of the standard compound (continuing calibration)

$$2378 - TCD \quad 30.8 + 2^* = 32.8$$

A_{IS} = AREA OF INTERNAL STANDARD

$$13012 - 2378 - TCD \quad 3101 + 3866 = 6967$$

I_{IS} = AMOUNT OF INTERNAL STANDARD 10 ng

2.5 = FACTOR FOR SIGNAL/NOISE ACCEPTANCE

i.e.: $s/n > 2.5$ for acceptance of signal as statistically significant.

RF = RESPONSE FACTOR FOR ANALYTE 1.028
(from Continuing Calibration 170770)

WT. = WEIGHT OF SAMPLE 10.0 g

EXAMPLE:

FILE:

$$\frac{(32.8)(10 \text{ ng})}{(6967)(10 \text{ g})(1.028)} \times 2.5 = .01 \text{ ppb}$$

* 2 used for background (no peak)

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CALCULATIONS OF SAMPLE RESULT:

$$\text{concentration} = \frac{[A_s][I_{is}]}{[A_{is}][RF_s][W]}$$

WHERE:

A_s = AREA FOUND FOR SAMPLE

2378-TCDF

$$4370 + 5926 = 10296$$

A_{is} = AREA FOUND FOR INTERNAL STANDARD

136-2378-TCDF

$$2277 + 2619 = 4896$$

I_{is} = AMOUNT OF INT. STD.

10 ng

RF_s = RESPONSE FACTOR FOR ANALYTE

1.499

(from Continuing Calibration M870770)

W = MASS OF SAMPLE

7.03 g

EXAMPLE: 2378-TCDF FILE: M870773

$$\frac{(10296)(10 \text{ ng})}{(4896)(1.499)(7.03 \text{ g})} = 1.996 \text{ ng/g} = 1.996 \text{ ppb}$$

TLI#8701364
DATE 4-24-87

TRIANGLE LABORATORIES, INC.
MATRIX SPIKE

SAMPLE # SAS2882E05 MS

ISOMER	NATIVE (ppb)	SPIKED (ppb)	OBSERVED (ppb)	%RECOVERY
2378-TCDD	ND(.001)	.49	.53	107%
123478-PCDD	ND(.002)	2.43	2.48	102%
123478-HxCDD	ND(.002)	2.43	2.27	93%
123679-HxCDD	ND(.002)	2.43	2.49	102%
123789-HxCDD	ND(.002)	2.43	2.34	96%
1234678-HpCDD	ND(.003)	2.43	2.60	107%
OCDD	.06	4.87	4.91	100%
2378-TCDF	ND(.001)	.49	.55	113%
12378-PCDF	ND(.001)	2.43	2.45	101%
234678-PCDF	ND(.001)	2.43	2.43	100%
123478-HXCDF	ND(.001)	2.43	2.39	98%
123678-HxCDF	ND(.001)	2.43	2.46	101%
234678-HXCDF	ND(.001)	2.43	2.38	98%
123789-HXCDF	ND(.001)	2.43	2.37	97%
1234678-HpCDF	.02	2.43	2.53	103%
1234789-HpCDF	ND(.011)	2.43	2.73	112%
OCDF	.05	4.87	5.18	105%

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TLI#8701364
DATE 4-24-87

TRIANGLE LABORATORIES, INC.
MATRIX SPIKE
SAMPLE # SAS2882E05 MSD

ISOMER	NATIVE (ppb)	SPIKED (ppb)	OBSERVED (ppb)	%RECOVERY
2378--TCDD	ND(.001)	.49	.56	114%
123478-PCDD	ND(.002)	2.47	2.67	108%
123478-HxCDD	ND(.002)	2.47	2.15	87%
123679-HxCDD	ND(.002)	2.47	2.44	99%
123789-HxCDD	ND(.002)	2.47	2.36	96%
1234678-HpCDD	ND(.003)	2.47	2.70	109%
OCDD	.06	4.94	5.12	102%
2378--TCDF	ND(.001)	.49	.59	120%
12378-PCDF	ND(.001)	2.47	2.54	103%
234678-PCDF	ND(.001)	2.47	2.63	107%
123478-HXCDF	ND(.001)	2.47	2.33	94%
123678-HxCDF	ND(.001)	2.47	2.33	94%
234678-HXCDF	ND(.001)	2.47	2.35	95%
123789-HXCDF	ND(.001)	2.47	2.34	95%
1234678-HpCDF	.02	2.47	2.61	105%
1234789-HpCDF	ND(.011)	2.47	2.82	114%
OCDF	.05	4.94	5.28	106%

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TLI#8701364
DATE 4-24-87

TRIANGLE LABORATORIES, INC.
MATRIX SPIKE
SAMPLE # SAS2882E05 MS AND SAS2882E05 MSD

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ISOMER	MS(TOTAL) (ng)	MSD(TOTAL) (ng)	AVERAGE (ng)	ABS	DEVIATION %DEV
2378-TCDD	5.402	5.657	5.530	.128	2%
TOTAL TCDD	5.402	5.657	5.530	.128	2%
123478-PCDD	25.470	26.970	26.220	.750	3%
TOTAL PCDD	25.470	26.970	26.220	.750	3%
123478-HxCDD	23.282	21.768	22.525	-.757	-3%
123679-HxCDD	25.603	24.683	25.143	-.460	-2%
123789-HxCDD	24.011	23.883	23.947	-.064	-0%
TOTAL HxCDD	72.835	70.172	71.503	-1.331	-2%
1234678-HpCDD	26.661	27.324	26.992	.332	1%
TOTAL HpCDD	26.661	27.324	26.992	.332	1%
OCDD	50.374	51.814	51.094	.720	1%
2378-TCDF	5.679	5.930	5.805	.126	2%
TOTAL TCDF	5.679	5.930	5.805	.126	2%
12378-PCDF	25.172	25.745	25.459	.287	1%
234678-PCDF	24.915	26.646	25.780	.865	3%
TOTAL PCDF	50.138	52.209	51.174	1.035	2%
123478-HXCDF	24.556	23.539	24.047	-.508	-2%
123678-HxCDF	25.223	23.569	24.396	-.827	-3%
234678-HXCDF	24.443	23.802	24.122	-.320	-1%
123789-HXCDF	24.289	23.661	23.975	-.314	-1%
TOTAL HxCDF	98.592	94.531	96.561	-2.031	-2%
1234678-HpCDF	25.963	26.383	26.173	.210	1%
1234789-HpCDF	28.068	28.518	28.293	.225	1%
TOTAL HpCDF	53.887	54.749	54.318	.431	1%
OCDF	53.219	53.423	53.321	.102	0%

TRIANGLE LABORATORIES, INC.
PCDD/PCDF ANALYSIS

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ANALYST MAW FILE # M870771
DATE 4-23-87 CONCAL # M870770
SAMPLE WEIGHT 10.00 TLI # 8701364
SAMPLE ID SAS 2882 TLI BLANK

NAME	CONC. (ppb)	NUMBER	DL	RATIO	RT
2378-TCDD	ND		0.011	15.400	26.36
TOTAL TCDD	ND	0	0.011	15.400	
12378-PCDD	ND		0.016	19.500	32.30
TOTAL PCDD	ND	0	0.016	19.500	
123478-HxCDD	ND		0.002	1.000	
123678-HxCDD	ND		0.002	1.000	
123789-HxCDD	ND		0.003	1.000	
TOTAL HxCDD	ND	0	0.025	1.241	
1234678-HpCDD	ND		0.003	1.000	
TOTAL HpCDD	ND	0	0.003	1.000	
OCDD	ND		0.021	0.100	49.58
2378-TCDF	ND		0.023	0.626	25.54
TOTAL TCDF	ND	0	0.023	0.626	
12378-PCDF	ND		0.001	1.000	
23478-PCDF	ND		0.040	0.850	32.08
TOTAL PCDF	ND	0	0.032	0.850	
123478-HxCDF	ND		0.001	1.000	
123678-HxCDF	ND		0.001	1.000	
234678-HxCDF	ND		0.001	1.000	
123789-HxCDF	ND		0.058	1.613	38.00
TOTAL HxCDF	ND	0	0.052	1.613	
1234678-HpCDF	ND		0.002	1.000	
1234789-HpCDF	ND		0.002	1.000	
TOTAL HpCDF	ND	0	0.002	1.000	
OCDF	ND		0.003	1.000	

SURROGATE RESULTS SUMMARY

NAME	CONC. (ppb)	% RECOVERY	RATIO	RT
13C12-TCDF	1.04	104.38	0.805	25.56
37C1-TCDD	1.13	112.95		26.37
13C12-HxCDF	1.03	102.91	1.218	35.58

INTERNAL STANDARDS RECOVERY RESULTS

NAME	CONC. (ppb)	% RECOVERY	RATIO	RT
2378-13C12-TCDD	0.90	89.82	0.802	26.36
13C12-PCDD	0.88	88.33	0.643	32.30
13C12-HxCDD	0.95	95.42	1.296	37.09
13C12-HpCDD	0.83	83.16	1.105	43.51
13C12-OCDD	1.53	76.60	0.905	49.58

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TRIANGLE LABORATORIES, INC.
PCDD/PCDF ANALYSIS

ANALYST JAJ/MAW FILE # M870724
DATE 4-23-87 CONCAL # M870720
SAMPLE WEIGHT 5.48 TLI # 8701364
SAMPLE ID SAS 2882 E01

NAME	CONC. (ppb)	NUMBER	DL	RATIO	RT
2378-TCDD	ND		0.157	0.577	26.34
TOTAL TCDD	15.108	8		0.794	
12378-PCDD	0.382			0.539	32.32
TOTAL PCDD	12.905	11		0.603	
123478-HxCDD	0.511			1.301	37.03
123673-HxCDD	1.173			1.420	37.10
123789-HxCDD	1.812			1.177	37.37
TOTAL HxCDD	16.645	7		1.267	
1234678-HpCDD	10.743			1.050	43.50
TOTAL HpCDD	20.955	2		1.027	
OCDD	20.527			0.874	49.59
2378-TCDF	15.972			0.750	25.53
TOTAL TCDF	71.147	17		0.750	
12378-PCDF	2.103			0.659	31.13
23478-PCDF	6.193			0.617	32.06
TOTAL PCDF	48.197	14		0.629	
123478-HxCDF	10.676			1.231	35.57
123673-HxCDF	3.744			1.217	36.06
234678-HxCDF	8.475			1.236	36.52
123789-HxCDF	0.675			1.188	37.58
TOTAL HxCDF	48.344	12		1.228	
1234678-HpCDF	30.401			1.007	42.22
1234789-HpCDF	8.204			0.972	44.28
TOTAL HpCDF	58.975	4		1.002	
OCDF	64.718			0.896	50.12

SURROGATE RESULTS SUMMARY

NAME	CONC. (ppb)	% RECOVERY	RATIO	RT
13C12-TCDF	1.953	107.05	0.788	25.52
37C1-TCDD	1.998	109.51		26.34
13C12-HxCDF *	2.238	122.63	0.761	35.58

INTERNAL STANDARDS RECOVERY RESULTS

NAME	CONC. (ppb)	% RECOVERY	RATIO	RT
2378-13C12-TCDD	1.613	88.42	0.847	26.33
13C12-PCDD	1.474	80.78	0.722	32.31
13C12-HxCDD	1.670	91.49	1.223	37.10
13C12-HpCDD	1.467	80.37	1.149	43.50
13C12-OCDD	2.626	71.95	0.848	49.59

* interference

TRIANGLE LABORATORIES, INC
2,3,7,8-TCDD/TCDF ANALYSIS

RECEIVED MAY 14 1987

ANALYST MDC FILE # M870797
DATE 4/25/87 CONCAL # M870795
SAMPLE WEIGHT 5.48 TLI # 8701364
SAMPLE ID SAS 2882E01

NAME	CONC (ng/g)	DL	RATIO	RT
2378-TCDF	2.55		0.814	27.27
2378-TCDD	0.11		0.838	22.54

SURROGATE RESULTS SUMMARY

NAME	CONC (ng/g)	% RECOVERY	RATIO	RT
13C12-TCDF	2.11	115.42	0.804	27.24
13C12-TCDD	2.27	124.54		22.55

INTERNAL STANDARDS RECOVERY RESULTS

NAME	CONC (ng/g)	% RECOVERY	RATIO	RT
2378-13C12-TCDD	2.36	129.11	0.810	22.53

TRIANGLE LABORATORIES, INC.
PCDD/PCDF ANALYSIS

RECEIVED MAY 14 1987

ANALYST	MAW	FILE #	M870773
DATE	4-23-87	CONCAL #	M870770
SAMPLE WEIGHT	7.03	TLI #	8701364
SAMPLE ID	SAS 2882 E02		

NAME	CONC. (ppb)	NUMBER	DL	RATIO	RT
2378-TCDD	ND		0.034	1.526	26.33
TOTAL TCDD	0.632	2		0.750	
12378-PCDD	0.034			0.542	32.30
TOTAL PCDD	0.989	7		0.600	
123478-HxCDD	0.063			1.051	37.03
123678-HxCDD	0.152			1.000	37.11
123789-HxCDD	0.226			1.182	37.40
TOTAL HxCDD	1.993	6		1.220	
1234678-HpCDD	1.678			1.084	43.51
TOTAL HpCDD	3.269	2		1.056	
OCDD	5.053			0.873	50.00
2378-TCDF	1.996			0.737	25.53
TOTAL TCDF	8.874	13		0.738	
12378-PCDF	0.259			0.600	31.13
23478-PCDF	0.692			0.597	32.05
TOTAL PCDF	5.049	11		0.608	
123478-HxCDF	1.426			1.396	35.57
123678-HxCDF	0.533			1.429	36.07
234678-HxCDF	1.171			1.223	36.53
123789-HxCDF	0.083			1.296	38.00
TOTAL HxCDF	6.317	10		1.305	
1234678-HpCDF	4.378			1.018	42.23
1234789-HpCDF	1.077			0.995	44.29
TOTAL HpCDF	8.406	4		1.010	
OCDF	9.532			0.888	50.12

SURROGATE RESULTS SUMMARY

NAME	CONC. (ppb)	% RECOVERY	RATIO	RT
13C12-TCDF	1.399	98.32	0.807	25.51
37C1-TCDD	1.379	96.97		26.33
13C12-HxCDF	1.426	100.24	1.219	35.58

INTERNAL STANDARDS RECOVERY RESULTS

NAME	CONC. (ppb)	% RECOVERY	RATIO	RT
2378-13C12-TCDD	1.307	91.90	0.869	26.32
13C12-PCDD	1.237	86.99	0.647	32.30
13C12-HxCDD	1.324	93.07	1.241	37.10
13C12-HpCDD	1.204	84.62	1.063	43.51
13C12-OCDD	2.250	79.10	0.878	49.59

RECEIVED MAY 14 1987

TRIANGLE LABORATORIES, INC
2,3,7,8-TCDD/TCDF ANALYSIS

ANALYST MDC FILE # M870798
DATE 4/25/87 CONCAL # M870795
SAMPLE WEIGHT 7.03 TLI # 8701364
SAMPLE ID SAS 2881E02

NAME	CONC (ng/g)	DL	RATIO	RT
2378-TCDF	0.65		0.802	26.49
2378-TCDD	0.08		0.683	22.41

SURROGATE RESULTS SUMMARY

NAME	CONC (ng/g)	% RECOVERY	RATIO	RT
13C12-TCDF	1.45	101.72	0.799	26.47
37C1-TCDD	1.55	109.19		22.41

INTERNAL STANDARDS RECOVERY RESULTS

NAME	CONC (ng/g)	% RECOVERY	RATIO	RT
2378-13C12-TCDD	1.42	100.00	0.813	22.39

RECEIVED MAY 14 1987

TRIANGLE LABORATORIES, INC.
PCDD/PCDF ANALYSIS

ANALYST JAJ FILE # M870775
DATE 4-23-87 CONCAL # M870770
SAMPLE WEIGHT 8.93 TLI # 8701364
SAMPLE ID SAS 2882 E03

NAME	CONC. (ppb)	NUMBER	DL	RATIO	RT
2378-TCDD	ND		0.021	0.822	26.36
TOTAL TCDD	0.297	6		0.794	
12378-PCDD	0.036			0.543	32.35
TOTAL PCDD	0.435	7		0.586	
123478-HxCDD	0.029			1.195	37.07
123678-HxCDD	0.091			1.132	37.16
123789-HxCDD	0.140			1.322	37.43
TOTAL HxCDD	0.988	6		1.338	
1234678-HpCDD	1.080			1.024	43.55
TOTAL HpCDD	2.071	2		1.015	
OCDD	4.291			0.882	50.04
2378-TCDF	0.669			0.772	25.53
TOTAL TCDF	3.151	15		0.749	
12378-PCDF	0.091			0.551	31.10
23478-PCDF	0.250			0.635	32.08
TOTAL PCDF	2.184	13		0.601	
123478-HxCDF	0.601			1.274	36.01
123678-HxCDF	0.211			1.442	36.11
234678-HxCDF	0.468			1.280	36.56
123789-HxCDF	ND		0.001	1.000	
TOTAL HxCDF	2.560	10		1.268	
1234678-HpCDF	1.991			0.988	42.28
1234789-HpCDF	0.349			1.042	44.33
TOTAL HpCDF	3.411	4		0.989	
OCDF	3.281			0.892	50.16

SURROGATE RESULTS SUMMARY

NAME	CONC. (ppb)	% RECOVERY	RATIO	RT
13C12-TCDF	1.198	106.98	0.762	25.53
37C1-TCDD	1.263	112.75		26.36
13C12-HxCDF	1.095	97.75	1.193	36.02

INTERNAL STANDARDS RECOVERY RESULTS

NAME	CONC. (ppb)	% RECOVERY	RATIO	RT
2378-13C12-TCDD	1.027	91.71	0.804	26.35
13C12-PCDD	0.947	84.53	0.606	32.34
13C12-HxCDD	1.040	92.89	1.250	37.14
13C12-HpCDD	1.090	97.31	1.042	43.54
13C12-OCDD	2.200	98.23	0.898	50.03